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# Squat & Grow: Designing Smart Human-Food Interactions in Singapore

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## ABSTRACT
Squat & Grow was a two-week series of workshops, talks and field trips aimed to support a sustainable food culture in Singapore, and test alternative scenarios of the Smart Nation plan. The project encouraged citizens to participate and co-design an open platform organized around DIY low-cost technology and "smart" food practices. In this paper, we describe two Squat & Grow workshops run by tutors from Indonesia and Singapore, and show how the Smart Nation can be differently built through DIY biological and technological activities. We also demonstrate how Singapore becomes a conduit rather than a center for technological innovation and economic development within the region.

### Author Keywords
Food; DIY; Maker; Smart Nation; Singapore; HCI

### ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

## INTRODUCTION
Squat & Grow (S&G) was a two-week series of workshops, talks, and field trips aimed to support a sustainable food culture in Singapore, and test alternative scenarios of a smart city [13]. S&G served as a site where citizens co-designed an open platform organized around do-it-yourself (DIY) low-cost technology and "smart" food practices. In this sense, the project is a DIY response to existing smart city plans claiming to use technology to create transparent interactions between citizens and various stakeholders through Internet of Things (IoT) technology [4]. S&G specifically addressed the Singapore's Smart Nation plan that promises to "harness technology and create more opportunities for citizens to engage in participatory activities" [7]. Even though Smart Nation introduces a variety of innovative solutions, most of them are leveraged from within the government or corporate sector and consider citizens only as end users. By inviting designers, researchers, hackers, and food-tech enthusiasts from Southeast Asia region (SEA), S&G aimed to test alternative scenarios of a peer-governed Smart Nation future built directly by citizens.

The project was initiated by three Ph.D. students (including authors) and supported by local initiatives Edible Garden City Singapore, Hackerspace.sg, and OneMaker Group (OMG). During the two weeks, S&G accommodated 21 events ranging from food workshops such as fermentation and herbal medicine tutorials to maker sessions on DIY food-tech gadgets. Instead of relying on government or corporate funds, we followed a grassroots model based on a free entry and a peer-sharing of resources as well as expenses. All S&G sessions were open to the public audience that was invited to participate actively by proposing their interventions into the scheduled program.

The field of HCI has shown considerable interest in food issues such as food sustainability, safety, or security. Scholars have offered a variety of scenarios to enhance resilient food production and distribution [2,3,9], while accentuating a need for consumers' direct hands-on engagement in "everyday food science" [8]. While addressing the specific context of food sustainability in Singapore, the S&G encouraged citizens' participation in traditional as well as more experimental food practices to inspire alternative Smart Nation visions. Here, we describe two S&G workshops and show how the Smart Nation can be differently built through DIY biological and technological activities. We also demonstrate how Singapore becomes a conduit rather than a center for technological innovation within SEA, and discuss a need to dismantle the very hub-ness of Singapore for more inclusive transnational collaborations within the region.

## SMART (FOOD) CITIES
The concept of smart city involves the use of ICT to transform life and working environments beneficial for the city and its citizens [4]. Thus, the inclusion of lay people in the making of a smart city is essential. However, present smart city plans mostly include lay people as mere users of ready-made solutions, and preserve the creative processes in the hands of experts and start-up intelligence [4,7]. HCI scholars have questioned such lay-expert divide that sees lay people as incapable of understanding complex or expert issues and highlighted advantages of non-experts' inclusion in social innovation processes [1,8,11].

The S&G project followed this recommendation and probed a scenario of "smart" urban future developed not only *for citizens* by also directly *by citizens* while considering expert stakeholders as a periphery to the featured decision-making processes. In this sense, we wanted to see what happens if we exclude the corporate or government-based authorities,

and put a full control over the creative processes into the hands of S&G participants.

Smart city plans concerned about environmental sustainability are highly connected to issues of sustainable food production [6]. Singapore's food supply is fulfilled largely by imports (over 90%), and the local food sustainability infrastructure is still rather immature. Probably the most palpable local food issue is the food wastage, which has risen by 50% over the last decade, with 788 600 tons of food waste produced every year [14]. However, as more Singaporeans realize the negative environmental and individual health impacts of unsustainable food practices, local demand for eco-friendly food products and services increases [12]. As a result, a number of citizen-driven food sustainability initiatives such as Urban Farmers Singapore, Edible Garden City Singapore, or Seeds Exchange Sg, have emerged all over the city-state. This shift has prompted local policymakers to improve people's overall awareness of sustainable food practices, and support their active participation [9]. Singapore's Smart Nation plan can be considered as one step in these efforts.

### Smart Nation Plan: Innovation and Sustainability in Singapore

Initiated by the Infocomm Development Authority of Singapore (IDA) in 2013, the Smart Nation plan represents Singapore's goals to become the first Smart Nation globally [7]. Along with the state's worries about the impact of population ageing and density on food, water, and energy resources, the initiative aims to encourage makers and tech entrepreneurs to resolve such issues collaboratively. Of particular relevance to our work is Smart Nation plan's strong emphasis on increasing the technical capacities of citizens, whether it be in tech-based entrepreneurial scenes or educational settings.

For instance, IDA committed an approximate S$10 million budget to build physical spaces for citizens, companies, and state representatives to engage in joint activities and "tinker with tech" [7]. While such plans express Singapore's desires to engage with smaller actors in innovation, the active role of citizens is still predetermined by the state's development pursuits. In other words, we recognize the state's strong desire but limited action to truly engage smaller technological actors both locally and regionally to co-design and co-produce "smart" technologies.

This is not to say that the Smart Nation plan is ill-intended and does not speak to citizens; where it fails at, is recognizing how citizens can also be co-creators, rather than mere consumers of ready-to-use solutions. Furthermore, Singapore's positioning of itself as a regional hub for SEA [7] suggests that technological innovation does not happen elsewhere, outside the city-state. S&G responds to these issues by steering meaningful public engagement in the making of the "smart" citizenship, as we show on the example of two organized workshops.

### SQUAT & GROW

The two-week event hosted close to 60 participants who provided their knowledge and skills as well as material resources, including occasional financial donations, to create an open platform for collaborative experiments with "smart" food practices. From the total number of 21 S&G events [13], we chose two that we think fit best into the format of this paper.

### Fermentation Workshop

S&G hosted several fermentation workshops, including DIY rice wine making by Sewon FoodLab Yogyakarta, kimchi tutorial by The Asian Raw Chef, and fermentation session run by a group of scholars from National University of Singapore (NUS) (figure 1).

**Figure 1. Fermentation workshop tutored by NUS students. Image © S&G.**

Along with these events, we aimed to support people's engagement in DIY food making and show a way to decrease our dependencies on the mass food market supply.

The NUS group gave a tutorial on vegetable pickling and introduced a scenario of a "smart" urban fermentation community connected via online tools, such as a crowdsourced online map or a Github cookbook of fermentation recipes [5]. They also prototyped a DIY fermentation incubator with light and temperature sensor regulated through the Arduino and open-source relay module. During the workshop, we further tinkered with the incubator (figures 2,3) and made some improvements (e.g. included a Wi-Fi microcontroller Photon to enable remote control).

From this initial stage, the "smart" fermentation project was released as a public initiative, which is now known as "Fermentation GutHub" [5]. The workshop organizers also asked the participants to bring their own mason jars and utensils to share them with others. This peer-sharing scenario worked well, and many participants even brought some fermentation ingredients and offered their own fermentation "starters" (i.e. microbial cultures catalyzing the fermentation process) for exchange. That inspired a scenario of a peer-managed public space, where people would freely deposit and exchange their fermentation

starters. This scenario later materialized into the "Fermentation Bank" project, now operated under GutHub's agenda in the premises of Hackerspace.sg [5].

**Figure 2. The DIY fermentation incubator – temperature sensor. Image © S&G**

**Figure 3. The DIY fermentation incubator in the making. Image © S&G.**

At the end of the S&G event, we organized a tasting session of the fermented foods prepared during the workshops. One issue that emerged was participants' inquiry about the safety of consuming these DIY goods. We replied by reiterating that the peer-governed S&G initiative has no deputies responsible for safety risks, and all responsibilities are to be peer-shared. In this sense, we have seen that despite being interested in peer-learning methodologies around DIY fermentation techniques, participants were doubtful when it came to the very act of consumption of the food produced by their peers, particularly when these were not close friends. While some of the participants accepted the risk and tasted the offered food, others were cautious, claiming that this is exactly the point when DIY methods fail as compared to (allegedly) safe "evidence-based" mass-production. Concerns about the safety of DIY home-fermented foods brought some ideas related to a need to better connect amateur DIY fermentation techniques with existing sources of professional expertise. These incidents also opened a broader discussion on how to manage the potentially hazardous nature of experimental, decentralized DIY practices – an important issue to be addressed within the context of DIY hacker and maker culture in general.

**Fruit BioSynth Workshop**

Among the more non-conventional food experiments was the Fruit BioSynth workshop run by members of Lifepatch lab, Yogyakarta. Lifepatch is a citizen-driven collective of artists, DIYbiologists, and technologists focused on increasing access to scientific knowledge through the cross-disciplinary creation of artifacts and tools to make sense of and visualize environment in Indonesia. Lifepatch's participation in S&G emphasized the importance of bringing together different regional epistemologies and histories of scientific and technological innovation – a point we will further turn to in the discussion.

Two invited Lifepatch members held the workshop in National Design Centre with the logistical support of OneMaker Group. Building on Lifepatch's prior work, the workshop focused on the making of the "Tiger BioSynth" circuit – a bio-synthesizer designed by one of the Lifepatch members, Andreas Siagian (figures 4,5). The nearly 20 workshop participants with different domain expertise exchanged knowledge on the function of BioSynths' electronic components and experimented with its applications and uses. Thereby, the workshop aimed to demonstrate how DIY circuitry could be a sophisticated yet approachable form of technological production for data collection and translation.

The bio-based synthesizer translates conductive input data and information into sound outputs. In other words, the circuitry allows users to translate conductive inputs such as moisture (e.g. from the air, fruits, human hand, or any other biological device) into visceral sound outputs, thereby visualizing the external biodata in a multisensory way. Using simple components and equipment (alligator clips, buzzers, integrated circuits, soldering iron, circuit boards etc.) and comprehensible DIY techniques (soldering, gluing, wiring etc.), the BioSynth device serves as an important gateway for citizens to participate in the accessible technological production. More importantly, the event has also illustrated how the technical and artistic expertise from Indonesia matters to dominant tech-innovation hubs like Singapore.

**Figure 4 + 5. Tiger Biosynth PCB and Layout Design by Andreas Siagian. Image ©Lifepatch**

To build the Fruit Biosynths, the workshop organizers asked participants to bring fruits native to the region and treat its moisture as data that can be visualized and embodied through sound (figure 6). The amount of moisture in any one of these fruits was to be translated into different frequencies, producing different sound pitches according to how "wet" a certain fruit is. The act of translating the local fruits' biodata that one cannot commonly see and decipher encouraged participants to think about the content of various local foods beyond its "mere" nutritional values. In this sense, the Fruit Biosynths symbolized not only a need for greater access to various food data and information, but also for a reflexive multidisciplinary engagement with issues pertaining to environmental sustainability.

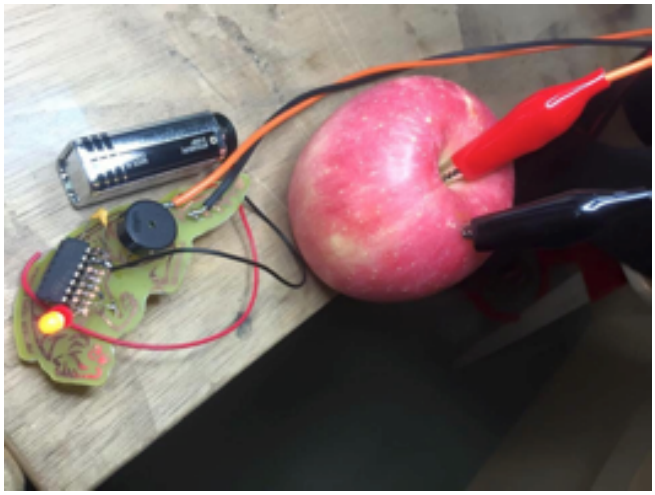

**Figure 6. Fruit Biosynth device. Image ©S&G.**

In all, the workshop aimed to evocate different senses and encouraged participants to adopt other modes of thinking about food and technology. From this, we learned how to run creative food experiments beyond conventional cooking practices and dependency on expensive proprietary tools. Moreover, Lifepatch's workshop exemplifies how Indonesian technologists and artists could legitimize their innovations in Singapore. S&G encouraged participants to acknowledge the technological work that Indonesians do and, in turn, question Singapore's position as an innovation hub for SEA region.

**DISCUSSION**

With the S&G project, we aimed to not only test possible future scenarios of sustainable and symbiotic urban communities gathered around food, but also to show alternative bottom-up enactments of Smart Nation of Singapore. By including citizens directly in the organization and decision processes around the two-week-long S&G initiative, the S&G organizers encouraged the ethos of low-cost production, free access, and community self-governance.

This DIY model was not an attempt to replace the state-initiated Smart Nation – in fact, we have seen both pros and cons of our efforts, with interesting ambiguities related to risks and responsibility-sharing. The exclusion of larger stakeholders and corporate intermediaries provided a space for flexible impromptu interactions, which brought some unexpected and desirable results (e.g. the foundation of the Fermentation Bank). However, the participants' reticence to accept responsibility for the "smart" collective actions (e.g. the tasting of the DIY fermented food) proved to be a problematic issue. In other words, while most of the S&G participants offered to share their knowledge as well as material resources to support the peer-driven food sustainability efforts, the willingness to accept the experimental outcomes of these efforts was limited. We have identified two kinds of legitimizing work that need to be done to further develop such "smart" DIY scenarios.

First, to facilitate food sustainability practices through DIY methods of low-cost peer-production, we have to better legitimize the expert-amateur ethos that citizens still perceive as risky. The traditional pre-industrial events of food production and consumption have been dissolved in the mass production processes, and the notion of everyday food making as a pleasurable and sustainable, but also experimental and just activity needs to be rejuvenated within the present context of urban food systems.

Second, we should support the sustenance of legitimate knowledge production in neighboring countries to counterbalance the position of Singapore as the exclusive innovation hub for SEA. The city-state has successfully facilitated creative production and innovation efforts across disciplines; however, the fact that intelligence and creativity resides also elsewhere in the SEA region needs to be better recognized. For instance, the Fruit BioSynth workshop, a materialization of preexistent exchanges between Singapore and Indonesia, demonstrate how diverse "smart" DIY opportunities can grow out of a mutual regional respect for each other's expertise. Instead of reiterating uneven Global North-Global South relations, the BioSynth workshop served as a platform for Singaporean participants to realize that technical and artistic expertise also exist outside of

dominant hubs of tech production and innovation. By facilitating such collaborations, it is important to consider how the Smart Nation plan in Singapore can also serve as a site wherein stakeholders not only internationalize, but also regionalize technological design, production, and innovation. That is, supporting a citizen-driven Smart Nation should not preclude dismantling previous assumptions that marginal sites of innovation such as Indonesia are only capable for mass-producing "smart" technologies and are not capable of designing them.

Both efforts relate to the S&G long-term goals of inquiring into what a Smart Nation is and how it can best promote sustainable development. We see such efforts as frontiers to encourage Singaporeans to reconsider the established state-centric development strategies. Such work serves as entry-point for future S&G pursuits to support not only DIY initiatives in urban food production but also alternative Smart Nation visions.

## CONCLUSION

S&G became an experiment combining food, technology and DIY methods to encourage citizens' participation in self-governed innovation outside the expert circles. This allowed participants to re-think present and future frames of local food policies and use food as a medium in response to looming Smart Nation efforts. We see such grassroots interventions in pre-defined social innovation frameworks as important and viable way to supplement state-centric visions of "smart" futures. The option for lay people to actively participate in such interventions is vital for the development of smart cities, Smart Nation, and similar "smart" sustainable initiatives. Within the SEA context, we see it as extremely important to develop transnational collaborations similar to S&G, and better connect the Singapore's innovation scene with technological and intellectual capital of citizens from neighboring countries.

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